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Quality of Canadian food-type soybeans

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Introduction

This report presents the quality data for the 2018 harvest survey of Canadian food-type soybeans conducted by the Canadian Grain Commission. Samples collected through the cooperation of Soy Canada, soybean processors and producers across Prairies, Ontario, Quebec and Atlantic regions were submitted to the Canadian Grain Commission's Grain Research Laboratory for analysis.

Growing and harvesting conditions

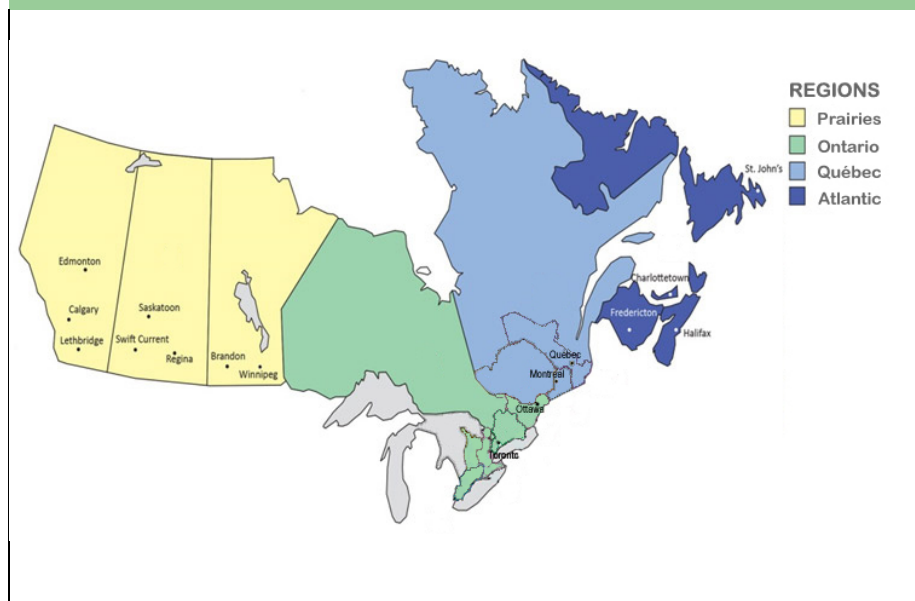
Dry field conditions in early May allowed seeding operations to get underway in the Prairies, and by early June, seeding operations were nearing completion. Rainfall in late May combined with warm temperatures resulted in rapid germination and crop growth. Warm weather and precipitation were norm in June throughout the Prairies. Hot temperatures in July helped crop development. Warm and dry conditions in early August caused some stress in many crops, and rainfall was needed to help with grain fill. Rainfall and below than normal temperatures in September and early October caused the significant delay in harvest and some damage in some crops.

In Ontario, a wet spring resulted in challenging planting conditions and reduced stands. Much of May, June, and even the first half of July were very dry and caused some stress in the crop. However, above average rainfall in late July and August helped crop development, which resulted in the highest provincial yields on record.

Harvest survey samples

The Canadian Grain Commission (CGC) received 14 natto-type and 266 generic food-type soybean samples including 3 from Prairies, 187 from Ontario, 87 from Quebec and 3 from Atlantic region. All samples were graded by the CGC's Industry Services (IS) and were Canada No.2 or higher. Composite samples were prepared according to region as shown in Fig. 1. All composite samples were analyzed for 100-seed weight, water absorption capacity/water uptake factor, protein, oil, sugar and total isoflavones content. Protein and oil content were determined using a Tecator Infratec 1241 Grain Analyzer near-infrared (NIR) spectrometer which was calibrated and verified against the appropriate laboratory reference method. Sugars and isoflavones were analyzed by high performance liquid chromatography (HPLC) methods. It is important to note that samples reported by grade do not necessarily represent the actual distribution of grade.

Figure 1 – Map of Canada showing origin of 2018 food-type soybean samples from CGC's Harvest Sample Program



Quality of 2018 Canadian food-type soybeans

Protein and oil content

Protein content for 2018 Canadian food-type soybeans ranged from 34.8 to 50.5 g per 100 g dry matter or 30.3 to 43.9 g per 100 g at 13% moisture basis (Table 1). The mean protein content in 2018 was 41.8 g per 100 g dry matter or 36.4 g per 100 g at 13% moisture basis, which was higher than the mean in 2017 (41.4 g per 100 g dry matter or 36.0 g per 100 g at 13% moisture basis). The mean protein contents for Prairies, Ontario, Quebec and Atlantic for 2018 were 38.0, 42.0, 41.3 and 46.2 g per 100 g dry matter, respectively.

Oil content for 2018 Canadian food-type soybeans varied from 17.3 to 24.9 g per 100 g dry matter or 15.1 to 21.7 g per 100 g at 13% moisture basis (Table 2). The mean oil content in 2018 was 21.8 g per 100 g dry matter or 19.0 g per 100 g at 13% moisture basis, which was higher than that for 2017 (20.3 g per 100 g dry matter or 17.7 g per 100 g at 13% moisture basis). The mean oil content for Prairies in 2018 was 21.2 g per 100 g dry matter. The mean oil content for Ontario in 2018 was 21.8 g per 100 g dry matter, which was higher than that in 2017. The mean oil content for Quebec in 2018 was 22.0 g per 100 g dry matter, which was higher than the mean for 2017. The mean oil content for Atlantic in 2018 was 18.8 g per 100 g dry matter, which was lower than that in 2017.

Canadian generic food-type soybeans

Table 3 shows the quality data for 2018 Canadian generic food-type soybeans used for tofu, soymilk or miso. Mean 100-seed weight for 2018 generic food-type soybean was 21.7 g, which was higher than the mean for 2017 (19.9 g). Water absorption capacity was 1.13 g H₂O per g seeds, which was similar to that for 2017. Water uptake factor was 2.13 for 2018. Seed size and water uptake are important quality characteristics of food-type soybeans for the production of tofu, soymilk and miso.

The mean protein content for 2018 Canadian generic food-type soybean was 41.8 g per 100 g dry matter or 36.4 g per 100 g at 13% moisture basis (Table 3), which was higher than the mean for 2017 (41.1 g per 100 g dry matter or 35.8 g per 100 g at 13% moisture basis). The mean oil content for 2018 was 21.8 g per 100 g dry matter or 19.0 g per 100 g at 13% moisture basis, which was higher than the mean for 2017 (20.3 g per 100 g dry matter or 17.7 g per 100 g at 13% moisture basis).

The mean sucrose content in 2018 generic food-type soybean was 59.3 g per kg dry matter, which was lower than the mean for 2017 (70.4 g per kg dry matter) (Table 3). The mean total oligosaccharides content for 2018 was 44.6 g per kg dry matter, which was lower than the mean for 2017 (47.4 g per kg dry matter).

The mean total isoflavones content for 2018 Canadian generic food-type soybean was 2349 mg per kg dry matter, which was lower than the mean for 2017 (Table 3).

Canadian natto-type soybeans

Table 4 displays the quality data for 2018 Canadian natto-type soybeans. Mean 100-seed weight for 2018 natto-type soybean was 9.9 g, slightly higher than that in 2017. Water absorption value was 1.18 g H₂O per g seeds and water uptake factor was 2.18, slightly lower than that for 2017.

The mean protein content for 2018 Canadian natto-type soybean was 38.9 g per 100 g dry matter or 33.8 g per 100 g at 13% moisture basis, which was slightly lower than that in 2017 (Table 4). The mean oil content was 21.7 g per 100 g dry matter or 18.9 g per 100 g at 13% moisture basis, higher than the mean for 2017.

The mean sucrose content for 2018 Canadian natto-type soybean was 54.4 g per kg dry matter, lower than that in 2017 (Table 4). The mean oligosaccharides content was 51.6 g per kg dry matter, higher than that in 2017. The mean total isoflavones content was 2493 mg per kg dry matter, which was lower than the mean for 2017.

Table 1 – Mean protein content for 2018 Canadian food-type soybeans by grade and province¹

Province/Region	Protein content, g/100 g			
	Number of sample	2018		2017
		Mean	Range	Mean
Prairies				
Soybean, No. 1 Canada	NS ²	NS	NS	NS
Soybean, No. 2 Canada	3	38.0 (33.1)	37.0 (32.2) – 39.5 (34.4)	38.7 (33.7)
All grades	3	38.0 (33.1)	37.0 (32.2) – 39.5 (34.4)	38.7 (33.7)
Ontario				
Soybean, No. 1 Canada	84	41.6 (36.2)	35.7 (31.1) – 50.3 (43.8)	40.9 (35.6)
Soybean, No. 2 Canada	103	42.3 (36.8)	35.5 (30.9) – 50.5 (43.9)	41.1 (35.8)
All grades	187	42.0 (36.5)	35.5 (30.9) – 50.5 (43.9)	41.0 (35.7)
Quebec				
Soybean, No. 1 Canada	28	40.7 (35.4)	34.8 (30.3) – 47.6 (41.4)	42.5 (37.0)
Soybean, No. 2 Canada	59	41.6 (36.2)	34.8 (30.3) – 50.2 (43.7)	42.4 (36.9)
All grades	87	41.3 (35.9)	34.8 (30.3) – 50.2 (43.7)	42.5 (37.0)
Atlantic				
Soybean, No. 1 Canada	3	46.2 (40.2)	43.3 (37.7) – 47.9 (41.7)	37.9 (33.0)
Soybean, No. 2 Canada	NS	NS	NS	NS
All grades	3	46.2 (40.2)	43.3 (37.7) – 47.9 (41.7)	37.9 (33.0)
Canada				
Soybean, No. 1 Canada	114	41.4 (36.0)	34.8 (30.3) – 50.3 (43.8)	41.4 (36.0)
Soybean, No. 2 Canada	166	42.0 (36.5)	34.8 (30.3) – 50.5 (43.9)	41.5 (36.1)
All grades	280	41.8 (36.4)	34.8 (30.3) – 50.5 (43.9)	41.4 (36.0)

¹Protein content (Nx6.25) is determined by near infrared measurement calibrated against the Combustion Nitrogen Analysis reference method, which is expressed as dry basis. Values in parentheses are expressed at 13% moisture basis.

²NS=insufficient number of samples to generate a representative value.

Table 2 – Mean oil content for 2018 Canadian food-type soybeans by grade and province¹

Province/Region	Oil content, g/100 g			
	Number of sample	2018 Mean	Range	2017 Mean
Prairies				
Soybean, No. 1 Canada	NS ²	NS	NS	NS
Soybean, No. 2 Canada	3	21.2 (18.4)	21.0 (18.3) – 21.5 (18.7)	21.2 (18.4)
All grades	3	21.2 (18.4)	21.0 (18.3) – 21.5 (18.7)	21.2 (18.4)
Ontario				
Soybean, No. 1 Canada	84	22.1 (19.2)	17.5 (15.2) – 24.7 (21.5)	20.4 (17.7)
Soybean, No. 2 Canada	103	21.5 (18.7)	17.3 (15.1) – 24.9 (21.7)	20.4 (17.7)
All grades	187	21.8 (19.0)	17.3 (15.1) – 24.9 (21.7)	20.4 (17.7)
Quebec				
Soybean, No. 1 Canada	28	22.4 (19.5)	18.4 (16.0) – 24.6 (21.4)	20.0 (17.4)
Soybean, No. 2 Canada	59	21.8 (19.0)	17.6 (15.3) – 24.1 (21.0)	19.9 (17.3)
All grades	87	22.0 (19.1)	17.6 (15.3) – 24.6 (21.4)	19.9 (17.3)
Atlantic				
Soybean, No. 1 Canada	3	18.8 (16.4)	17.7 (15.4) – 20.5 (17.8)	21.2 (18.4)
Soybean, No. 2 Canada	NS	NS	NS	NS
All grades	3	18.8 (16.4)	17.7 (15.4) – 20.5 (17.8)	21.2 (18.4)
Canada				
Soybean, No. 1 Canada	114	22.1 (19.3)	17.5 (15.2) – 24.7 (21.5)	20.3 (17.7)
Soybean, No. 2 Canada	166	21.6 (18.8)	17.3 (15.1) – 24.9 (21.7)	20.2 (17.6)
All grades	280	21.8 (19.0)	17.3 (15.1) – 24.9 (21.7)	20.3 (17.7)

¹Oil content is determined by near infrared measurement calibrated against the ISO 10565:1992(E) reference method, which is expressed as dry basis. Values in parentheses are expressed at 13% moisture basis.

²NS=insufficient number of samples to generate a representative value.

Table 3 Quality data for 2018 Canadian generic food-type soybean composites¹

Quality parameter	Number of sample	2018	2017
Physical characteristic			
100-seed weight, g/100 seeds	229	21.7	19.9
Water absorption, g H ₂ O/g seeds	229	1.13	1.18
Water uptake factor, g soaked wt/g seeds	229	2.13	2.18
Chemical composition (g/100 g)²			
Protein content	229	41.8 (36.4)	41.1 (35.8)
Oil content	229	21.8 (19.0)	20.3 (17.7)
Sugar content (g/kg DM)			
Sucrose	229	59.3	70.4
Raffinose	229	8.1	9.3
Stachyose	229	35.1	37.5
Verbascose	229	1.3	0.56
Total oligosaccharides ³	229	44.6	47.4
Isoflavones (mg/kg DM)			
Total isoflavones ⁴	229	2349	3643

¹Soybean, No. 1 Canada and No. 2 Canada combined.

²Results are expressed as dry basis. Values in parentheses are expressed at 13% moisture basis.

³Sum of raffinose, stachyose and verbascose.

⁴Sum of isoflavone aglycones (daidzein, genistein and glycitein), glucosides, malonyl glucosides and acetyl glucosides.

Table 4 Quality data for 2018 Canadian natto-type soybean composites¹

Quality parameter	Number of sample	2018	2017
Physical characteristic			
100-seed weight, g/100 seeds	14	9.9	9.4
Water absorption, g H ₂ O/g seeds	14	1.18	1.25
Water uptake factor, g soaked wt/g seeds	14	2.18	2.25
Chemical composition (g/100 g)²			
Protein content	14	38.9 (33.8)	39.5 (34.4)
Oil content	14	21.7 (18.9)	19.6 (17.1)
Sugar content (g/kg DM)			
Sucrose	14	54.4	66.9
Raffinose	14	7.9	7.9
Stachyose	14	41.4	41.3
Verbascose	14	2.3	0.71
Total oligosaccharides ³	14	51.6	49.9
Isoflavones (mg/kg DM)			
Total isoflavones ⁴	14	2493	3207

¹Soybean, No. 1 Canada and No. 2 Canada combined.

²Results are expressed as dry basis. Values in parentheses are expressed at 13% moisture basis.

³Sum of raffinose, stachyose and verbascose.

⁴Sum of isoflavone aglycones (daidzein, genistein and glycitein), glucosides, malonyl glucosides and acetyl glucosides.

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